EFFECT OF CLOVES ON MEAT ANTIOXIDATIVE STATE OF BROILERS

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ABSTRACT
The effect of cloves on meat antioxidative state of broiler chicken was determined. A total of one hundred and ninety two day-old Cobb 500 broiler chicks were used for the feeding trial. There were four treatments replicated thrice with sixteen birds per replicate corresponding to 48 birds per treatment using a Completely Randomized Design. Treatment 1 was the control group, treatment 2 contained 0.2% cloves supplemented diet; treatment 3 contained 0.3% cloves supplemented diet while treatment 4 contained 0.4% supplemented diet. The feeding trial period was to determine the antioxidative state of broiler meat for eight weeks. The results showed that cloves supplemented diets significantly (P<0.05) increased muscle glutathione peroxidase concentration and catalase while reducing meat lipid oxidation and cholesterol content in broilers compared to the control group. The supplementation of 0.2% cloves increased the glutathione peroxidase and catalase.
Keywords: Muscle, cloves, antioxidant, lipid oxidation, glutathione peroxidase

INTRODUCTION

Recently, poultry industry has tremendously improved due to genetic selection and breeding engaged with which aimed in enhancing growth rate, increased muscle yield and improved nutritional content (Taverez and Solls, 2016). Due to the consumers' consciousness to the meat consumed, this has driven broiler producers to raise birds with lean meat and reduced fat including preference for meat products free from synthetic antibiotics residues (Mehdi *et al*., 2018). Significantly, there has been a heightened focus on upgrading the quality of broiler meat (Mir *et al*., 2017) and recent ban on the use of antibiotics in animal nutrition (Ma *et al*., 2021). To meet these demands, there is a growing trend towards the use of natural alternatives such as herbs and phytogenic plants in poultry ration as substitutes for conventional antibiotic feed supplements. Adu et al. (2020) and Oloruntola et al. (2021) reported that supplementation of medicinal plants or herb as feed additives in broiler diets could positively influence broilers performance and meat quality. These reports have highlighted the beneficial effects of bioactive substance present in herbs and medicinal plant on improved growth performance, improved nutrient digestion, enhanced muscle development and depletion of cholesterol in chicken (Adu et al., 2020; Oloruntola et al., 2021).

MATERIALS AND METHODS

The experimental site

The study was carried out in the Poultry Unit of the Department of Agricultural Technology. The Federal Polytechnic Ado, Ekiti State, Nigeria. The State is located in the South Western Nigeria. It covers a land area of 6,353km square (2453sqm) with two distinct seasons; the rainy season (April to October) and the dry season (November to March). Ado-Ekiti has a temperature range between 21° and 28°C with high humidity, the South Western wind and the North East trade which blows in the rainy season and the dry (harmattan) season, respectively.

Site preparation

The poultry house was thoroughly washed and fumigated with disinfectant. It was then allowed to stay, and dried for two weeks before the arrival of the experimental birds. Proper weeding of the surrounding was carried out to prevent predators and pests.

Experimental animals

A total of one hundred and ninety two (192) Cobb 500 broiler chicks were used in this experiment. There were 4 treatments and 3 replicates per treatment. Sixteen (16) birds were allotted per replicate corresponding to 48 birds per treatment. Vaccinations were given to the experimental birds at the appropriate time
The test ingredients cloves (*Syzygium aromaticum*) used were purchased from a local market, and air-dried for 13 days in order to reduce the moisture content. They were milled into fine particles and used to formulate the diets.

Experimental diets

The composition of experimental diets are presented in Table 1. The basal diets were formulated for broiler starter (0-28 days) and finisher phase (29-56 days). The basal diets were divided into 4:.
Diet 1: Control diet (without supplements)
Diet 2: Contained 0.2% cloves inclusion
Diet 3: Contained 0.3% cloves inclusion.

Diet 4: Contained 0.4% cloves inclusion.

Table 1: Composition of experimental diets (g/100kg) for broiler starter

Ingredient	Inclusion level of *Syzygium aromaticum*			
	T1 (0%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)
Maize	39	39	39	39
Soybean Meal (SBM)	26	26	26	26
Groundnut Cake	24	24	24	24
Fish Meal	2.5	2.5	2.5	2.5
Bone Meal	3	3	3	3
Limestone	2.5	2.5	2.5	2.5
Broiler Premix	0..20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25
Lysine	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25
Vegetable oil	2	2	2	2
Total	**100**	**100**	**100**	**100**
Calculated Analysis				
Crude protein (%)	23.76	23.76	23.76	23.76
Metabolizable Energy (kcal)	2919.12	2919.12	2919.12	2919.12
Calcium	2.24	2.24	2.24	2.24
Average phosphorus	0.73	0.73	0.73	0.73

Data collection

On the 56th day of the experiment, one bird per replicate was randomly selected, weighed and euthanized by severing the two jugular veins (Oloruntola *et al*., 2018). Prior to euthanasia, the birds were deprived of feed overnight. Breast meat samples were aseptically collected from the slaughtered chickens, packed aerobically in oxygen-permeable bags and stored frozen at -18^{0}C for 20 days. Breast meat samples were then analysed for lipid oxidation, glutathione peroxidase, catalase and cholesterol levels. The TBA reactive species technique was employed to assess meat lipid oxidation (Tokur *et al*., 2006) while the method described by Cichoski *et al*. (2012) and de Almeida (2006) was used to determine meat glutathione peroxidase, catalase and cholesterol concentrations respectively

Statistical analysis

All data collected in this study were subjected to analysis of variance (ANOVA) using Duncan Multiple Range Test was used to separate the means. Significant differences were considered where necessary at a level of $P<0.05$

RESULTS

The effect of cloves on lipid oxidation, glutathione peroxidase, catalase and cholesterol content of broiler meat are presented in table 2. Broilers fed control diet showed significantly higher meat lipid oxidation (1.64mgMDA/g) than those fed diets supplemented with 0.2% cloves (0.92mgMDA/g), 0.3% cloves (0.84mgMDA/g) and 0.4% cloves (1.01mgMDA/g). Similarly, the meat cholesterol content of broilers given a control diet (133.52mg/dl) was considerably ($P<0.05$) greater than that of broilers fed diets supplemented with 0.2% cloves (69.91mg/dl), 0.3% cloves (40.16mg/dl) and 0.4% cloves (27.06mg/dl). Conversely, broiler chickens fed the control diet had the lowest glutathione peroxidase and catalase content compared to those fed diets supplemented with 0.2%, 0.3% and 0.4% cloves.

Table 2: Effect of cloves supplementation on meat antioxidative state of broilers.

Parameters	DIET				±SEM	P-Value
	Diet 1 (0%)	Diet 2 (0.2%)	Diet 3 (0.3%)	Diet 4 (0.4%)		
Lipid oxidation (mgMDA/g)	1.64^a	0.92^{bc}	0.84^c	1.01^b	0.07	0.01
Glutathione peroxidase(mg/ml)	41.05^b	70.11^a	67.36^a	69.72^a	4.11	0.01
Catalase	55.06^b	68.52^a	67.74^a	67.97^a	0.13	0.01
Cholesterol (mg/dl)	133.52^a	69.91^b	40.16^c	27.06^c	19.72	0.01

^{a,b,c} means in the same row with different superscripts are significantly ($p<0.05$) different; SEM: standard error of the mean.

DISCUSSION

The ability of the inherent antioxidants such as flavonoid and eugenol in cloves to scavenge free radicals and inhibit oxidation production in animals could account for the significant reduction in meat lipid oxidation observed in broiler chickens fed a cloves supplemented diets. Recent studies have identified cloves as having high antioxidant scavenging abilities against free radicals and other reactive oxygen species that cause peroxidation in biological systems (Oloruntola *et al*., 2021). Falowo *et al*. (2014) reported that lipid oxidation has been identified as the primary cause of meat quality deterioration during storage suggesting that cloves supplementation in the diet could serve as a preservative to extend the meat's shelf life. This finding is in tandem with the result of Adu *et al.* (2020) who observed a reduction in lipid oxidation in the breast meat of broiler fed a diet supplemented with *Syzygium aromaticum* leaf powder. Moreso, researchers have demonstrated that adding phytogenics or phytochemicals to animal feed helps protect meat against lipid oxidation (Simitzis *et al*., 2011; Valenzuela-Grijalva *et al*., 2017). Similarly, the significant decrease in cholesterol levels observed in broiler chickens supplemented with 0.2%, 0.3% and 0.4% cloves compared to the control suggests that cloves contain hypocholesterolemic compounds (Oloruntola *et al*., 2021). Phytochemicals found in medicinal plants, spices have been shown to reduce cholesterol by inhibiting cholesterogenesis and fat storage in the carcass and other body areas (Santoso *et al*., 2000). The higher glutathione peroxidase and catalase recorded in broiler chickens fed cloves supplemented diet reveals the ability of cloves to enhance the animals's endogenous antioxidant capacity when used as an additive at this level. Endogenous antioxidant enzymes play a crucial role in protecting cells from the harmful effects of free radicals and reactive oxygen species (Jomova *et al*., 2024).

CONCLUSION

The supplementation of cloves in broiler chicken diets influenced the oxidative state of meat positively. It increased the antioxidant status suggesting its potential as an antioxidant agent.

RECOMMENDATION

Supplementing cloves at 0.2% in broiler chicken's diets had notable effect on meat oxidative state.

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